2002-2003 National Park Service Klamath Network Landbird Inventory
2002 Interim Report

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INTRODUCTION

The Klamath Bird Observatory (KBO) has entered into a partnership with the National Park Service Klamath Network (Network) to take part in their Inventory and Monitoring Program. In 2002 we began a two-year effort to:

- Establish bird monitoring stations and conduct avian inventories within the Network's Parks, Monuments and Recreation Areas (Units);
- Determine what additional information is available from previous bird monitoring efforts conducted within the Network; and
- Develop a longterm bird monitoring plan as part of the Klamath Network's Vital Signs Monitoring Program.

This interim report provides a summary of 2002 bird inventory efforts in the Klamath Network. Results from monitoring efforts which included:

- Breeding season bird censuses at Crater Lake National Park and Whiskeytown National Recreation Area;
- Breeding and migration season constant effort mist netting efforts at Oregon Caves National Monument; and
- Migration season census efforts at Lava Beds National Monument.

This report focuses on species that were detected using multiple monitoring techniques during breeding and migration seasons. The species detected are compared with the Klamath Network's current inventory lists. These lists document species that have been confirmed to occur, are hypothetically occur in the Recreation Area, Monuments and Parks that make up the Network. A brief summary of other datasets from previous bird monitoring efforts at Crater Lake and Redwood National Parks is also included. Results from our first year's efforts should be used to allocate inventory efforts for 2003, and to develop a long-term bird monitoring program for the Klamath Parks Network

METHODS

Breeding Season Census Effort: Crater Lake National Park and Whiskeytown National Recreation Area

Using GIS software (Environmental Systems Research Institute, Inc. 2000) and spatial habitat data we identified riparian and adjacent upland habitats along elevational gradients within Crater Lake National Park and Whiskeytown National Recreation Area. Bird point count census routes were established by placing six stations along riparian stretches and six additional stations in adjacent upland habitats. Each station was located 250m from adjacent points and their locations were recorded using GPS Units. Additional census routes were established in Crater Lake National Park control burn units as part of a Joint Fire Sciences project being conducted by KBO and are included in this summary.

During the 2002 breeding season bird abundance and habitat data were collected at each station using standardized point count census methodologies (Ralph et al. 1993). From May 23 to July 9 each station was

visited once and five-minute bird count censuses were conducted between sunrise and 1100 PDT. During these censuses, we recorded all bird species seen and heard. Distances to each bird were estimated following the variable circular plot method (Fancy and Sauer 2002). KBO biologists collected additional presence/absence data by maintaining daily lists of bird species encountered during each visit to the Park and Recreation Area.

Vegetation data were collected at each station using a relevé method. Total cover and height range for the tree, shrub, herb and moss layers (= 5 m, = 0.5 m and < 5 m, < 0.5 m, < 0.1m respectively) were estimated and the number of sublayers within each of these structural categories determined. Maximum and minimum DBH of trees in the tree layer were visually estimated. The covers of plant species within each sub-layer were determined using eight classes (0, <1, 1-5, 5-25, 25-50, 50-75, 75-100%), and we noted if permanent standing or running water occurred within 50m.

Relative abundances for birds detected at census stations were calculated for Crater Lake and Whiskeytown by dividing the total number of detections for a given species, by the total number of censuses conducted within each Unit respectively. Detection frequencies were also calculated for each Unit by dividing the total number of stations on which a species was detected, by the total number of stations within each Unit, respectively.

To demonstrate the effectiveness of using multiple bird monitoring methods, species detected during censuses are noted separately from those encountered incidentally. The occurrences of bird species within Crater Lake National Park and Whiskeytown National Recreation Area are considered with regards to each Unit's inventory species lists. These lists include hypothetical lists of species considered likely to occur in each Unit (hypothetical lists), and lists of species confirmed to occur in each Unit (voucher lists).

Conservation biologists and ecologists commonly employ species richness indices to examine relationships between the environment and animal populations (Meffe et. al. 1997). Using the bird census data, species richness was calculated for each route and for each station by counting the total number of species detected along the route and at stations. To consider the effectiveness of our inventory effort we plotted the incremental increase in the number of species detected with increasing inventory efforts in each Unit. We also plotted the number of species that were added to a total species list when considering incrementally increasing numbers of stations.

Constant-effort Mist-netting: Oregon Caves National Monument

During the 2002 field season the Klamath Bird Observatory established and operated a constant-effort mist-netting station in an important riparian are at Oregon Caves National Monument, following standard protocols (Ralph et al. 1992). Between June 12 and October 23 visits were made every 7 to 10 days during which 10 nets were opened for 5 hours. Birds were captured and banded and age, sex, breeding status and physiological condition were recorded for each individual. Area search censuses (Ralph et al. 1992) were conducted on two plots during each visit to the station, and point count censuses were conducted at two stations once during the breeding season. KBO biologists also collected species presence/absence data at Oregon Caves using daily lists as described above.

A list of species detected at the constant-effort station is provided, and the method of detection indicated to demonstrate the importance of multiple monitoring methods. Species that were captured and banded are noted separately from those encountered during censuses or incidentally. The occurrences of bird species within Oregon Caves are considered with regards to the Monument's hypothetical and voucher lists. The number of

species detected during the breeding season is compared with the number of birds detected during the non-breeding and migration season to demonstrate the importance of monitoring birds during both seasons.

Fall Migration Census Effort: Lava Beds National Monument

Using GIS software (Environmental Systems Research Institute, Inc. 2000) and spatial habitat data we identified pine/shrub-steppe habitats in Lava Beds National Monument. Bird area search census stations were established in groups of six, overlapping breeding season census routes established as part of KBO's Joint Fire Sciences project. Each area was located at least 250 m from adjacent areas and locations were recorded using GPS Units.

During the 2002 migration season bird abundance and habitat data were collected at each station using standardized area search census and habitat methodologies (Ralph et al. 1993). Between October 24 and 27, twenty-minute area searches were conducted between sunrise and 1100 PDT and all bird species seen and heard were recorded. Each area was visited once. Vegetation data were collected on each area using the relevé method described above.

The total number of species detected during these fall surveys is presented. The occurrences of bird species within Lava Beds are considered with regard to the hypothetical and voucher species lists.

Klamath Demographic Monitoring Network

The National Park Service Klamath Network falls within the boundaries of the Klamath Demographic Monitoring Network. This bird monitoring network is a regional, cooperative group of people and organizations that monitor birds in the Klamath Province (Hollinger and Ralph 1995). Its scope includes mist-netting stationsand point count censuses. It is comprised of many cooperators, operating some 45 constant-effort mist-netting stations in southern Oregon and northern Californiaand more than 15,000 point counts. As part of the Klamath Bird Observatory's 2002 inventory effort, we began to identify data that are available from previously implemented efforts within the Klamath Network's Parks, Recreation Areas, and Monuments.

We consider species that were detected during an intensive two-year point-count census effort conducted by the Point Reyes Bird Observatory at Lassen Volcanic National Park (Humple et al. 2001). We also consider species detected during rapid ornithological inventories conducted in 1999 and 2002 as part of the Klamath Bird Observatory's Upper Klamath Basin Bird Monitoring Program (Alexander and Ralph 2002). A rapid ornithological inventory (ROI) is an intensive two-day effort designed to augment regular monitoring sites and quickly gain a measure of the relative value of nearby bird habitats. The ROI protocol includes procedures for mist-netting, area search census, and owl monitoring. Additionally, we present a list of species that are a result of the US Forest Service Pacific Southwest Research Station's Redwood Sciences Laboratory's effort to monitor birds, and archive existing bird monitoring data in and around Redwood National Park. The species considered were detected during the Lab's efforts conducting point count censuses and operating a constant-effort mist-netting station following standard procedures, or included in data from local Breeding Bird Survey routes that were archived from the USGS Patuxent Wildlife Research Center (Sauer et al. 1999). The occurrences of bird species within Lassen Volcanic, Crater Lake, and Redwood National Parks are considered with regards to the respective Unit's hypothetical and voucher species lists.

RESULTS

Breeding Season Census Effort: Crater Lake National Park and Whiskeytown National Recreation Area

Nine riparian upland routes, and three additional routes associated with control burn areas, were established in Crater Lake National Park and censused during the 2002 breeding season (Figure 1, Table 1). Ten riparian upland routes were established in Whiskeytown National Recreation Area and censused during the 2002 breeding season (Figure 2, Table 2). A total of 234 stations were established in the Units.

Forty-two species were detected on the Crater Lake stations confirming the occurrences of 22 species from the Park's hypothetical list (Table 4). Two of the species detected (Black-backed Woodpecker and Olive-sided Flycatcher) were not included on the Park's hypothetical or voucher lists. Using the daily species lists the occurrences of 9 additional species (Western Grebe, Double-crested Cormorant, Mallard, Osprey, Vaux's Swift, Cliff Swallow, Brewer's Blackbird, European starling, and American Goldfinch) from the Park's hypothetical list, and 4 additional species (Three-toed Woodpecker, Common Nighthawk, Violet-green Swallow, and Vesper Sparrow) that were not included on the Park's hypothetical or voucher lists, were confirmed.

Sixty-seven species were detected on the Whiskeytown stations confirming the occurrences of 66 species from the Recreation Area's hypothetical list (Table 5). One of the species detected (Green Heron) was not included on the Park's hypothetical or voucher lists. Using the daily species lists the occurrences of 11 additional species (Western Grebe, Double-crested Cormorant, Mallard, Osprey, Band-tailed Pigeon, Vaux's Swift, Cliff Swallow, Barn swallow, Brewer's Blackbird, European starling, and American Goldfinch) from the Recreation Area's hypothetical list, and 2 additional species (Common Nighthawk, Violet-green Swallow) that were not included on the Recreation Area's hypothetical or voucher lists, were confirmed.

At both Crater Lake and Whiskeytown the difference between the number of species detected along one route, and the number detected along ten routes is two fold (Figure 3 and Figure 4). On both Units, the number of species detected increases by at least one for every 2 routes that were surveyed. At Crater Lake 40% (17 species) of 42 species detected on 144 stations were encountered on 5% of the stations (Figure 5). At Whiskeytown 42% (27 species) of 67 species detected on 108 stations were encountered on 5% of the stations (Figure 5). When the number of stations considered is doubled from five to ten percent, 67% (28 species) and 66% (44 species) of the total species encountered within Crater Lake and Whiskeytown respectively, are detected. When increasing the number of stations considered from 30% to 100%, eleven percent (5 species) and nine percent (6 species) of the total species encountered within Crater Lake and Whiskeytown respectively are added (Figure 5).

Ten species were detected on more than 19% of the Crater Lake bird census stations and 11 were detected on more than 19% of the Whiskeytown stations (Table 5). One species (Western Tanager) was among these most abundant birds at both Crater Lake and Whiskeytown. Three of the most abundant birds at Crater Lake (Mountain Chickadee, Hammond's Flycatcher, and Hermit Thrush) were not detected at Whiskeytown, and 7 of the most abundant birds at Whiskeytown (Black-throated Gray Warbler, Spotted Towhee, Orange-crowned Warbler, Black-headed Grosbeak, Hutton's Vireo, Lesser Goldfinch and Wrentit) were not detected at Crater Lake.

Constant-effort Mist-netting: Oregon Caves National Monument

During 2003 the Oregon Caves constant-effort mist-netting station was operated 8 times during the breeding season (June-August), and 7 times during the migration season (September-October). Two-hundred fifty-seven and 116 bird captures were recorded, and 15 and 14 area searches were conducted, during the breeding and migrations seasons respectively. A total of 49 species were either captured or encountered during our efforts at the Oregon Caves (Table 6). The occurrences of 46 species from the Monument's hypothetical list were confirmed and three species that were encountered (Canada Goose, Allen's Hummingbird and Townsend's Warbler) were not included on the Monument's hypothetical or voucher lists. By operating the monitoring station during both the breeding and migration seasons as apposed to during the breeding season only, we increased the number of species documented from 34 to 49 (Figure 6). By conducting area searches and keeping species lists while operating mist nets KBO biologists increased the number of species documented from 21 to 34 and from 18 to 39 during the breeding and migration seasons respectively (Table 6).

Fall Migration Census Effort: Lava Beds National Monument

During the fall migration season of 2002, 36 area search censuses were conducted at Lava Beds National Monument. Twenty-six species were detected during the surveys (Table 7). The occurrences of 18 species from the Monument's hypothetical list were confirmed and eight species that were detected (Horned Lark, Black-billed Magpie, Pinyon Jay, Vesper Sparrow, Golden-crowned Sparrow, Northern Shrike, Canyon Wren, and Juniper Titmouse) were not included on the Monument's hypothetical or voucher lists. Though fewer species were detected at Lava Beds than at Crater Lake, Whiskeytown, and Oregon Caves (Table 3, Table 4, Table 6) the number of species added to the Monument's lists was a higher proportion of the total species encountered (30%).

Klamath Demographic Monitoring Network

During 1999 and 2000 the Point Reyes Bird Observatory conducted extensive breeding season surveys in Lassen National Park (Humple et al. 2001). Three hundred twenty-five point count stations were surveyed. Fifty-six of the species detected during this effort were included on the Park's hypothetical list and their occurrences was confirmed by PRBO's efforts. Eight species detected during the 1999-2000 effort (Black-baced Woodpecker, Brewer's Sparrow, Cassin's Vireo, Gray Jay, Gray-crowned Rosy-finch, Lincoln's Sparrow, Pacific-slope Flycatcher, and Willow Flycatcher) were not included on the Park's hypothetical or voucher lists.

During 1999 the Klamath Bird Observatory conducted rapid ornithological inventories (ROIs) at Crater Lake National Park (Alexander and Ralph 2002) and during 2002 KBO completed a third rapid ornithological inventory (Figure 1). Eleven species encountered during the Crater Lake ROIs were not encountered at Crater Lake during our 2002 point count inventory effort. Four of these (Turkey Vulture, Song Sparrow, Great-horned Owl, and Belted Kingfisher) were included on the Park's hypothetical list and their occurrence confirmed by our efforts. One additional species encountered (Townsend's Warbler) was not included on the Park 's hypothetical or voucher lists.

Six point count census routes of 119 stations, and one constant-effort mist-netting station, were established in and around Redwood National Park by the US Forest Service Redwood Sciences Laboratory (Figure 7). Data from 150 census station along 3 Breeding Survey Routes from in and around the Park have been archived from the national dataset (Sauer et al. 2001) and are included in the Klamath Demographic Bird Monitoring Network dataset. A total of 95 species have been recorded at all of the stations combined. The data confirm the

occurrences of 69 species from the Park's hypothetical list. Ten species that were not included on the Park's hypothetical or voucher lists (Western Scrub Jay, Violet-green Swallow, Savannah Sparrow, Red-shouldered Hawk, Mountain Quail, Green Heron, Grasshopper Sparrow, Black-crowned Night-heron, Black-capped Chickadee, Allen's Hummingbird) are included in the data collected in and around Redwood National Park.

DISCUSSION

Breeding Season Census Effort: Crater Lake National Park and Whiskeytown National Recreation Area

The confirmation of occurrence of more than 100species demonstrates that the use of standardized point count census methodologies and detailed lists of birds encountered during visits to Parks, Monuments and Recreation Areas is an efficient and cost effective way to conduct avian inventories within the Klamath Parks Network during the breeding season. Additional benefits to conducting inventories in this manor include the establishment of baseline datasets to be used in developing a vital signs monitoring program for the Network (Fancy and Sauer 2002), and to compare bird abundance within and among National Park Units and adjacent landscapes.

Analyses of the number of species detected with increased census efforts results in an increasing curve similar to the 'species area curves' that are fundamental to the study of conservation biology studies (Meffe et al. 1997). When considering all stations surveyed within Crater Lake and Whiskeytown the majority of the species detected are encountered on the first 10% of the stations surveyed demonstrating that with little effort most of the birds within a Park will be encountered. Importantly however, when considering the 2002 surveys and the resulting species effort curves, a plateau in species richness was never achieved, demonstrating that an effort of this proportion did not max out the number of bird species potentially encountered within Crater Lake or Whiskeytown. A comparison of abundant birds at Crater Lake and Whiskeytown demonstrates the importance of regional networks of protected areas when considering the conservation of biological diversity at a provincial level. Both Crater Lake and Whiskeytown are protecting habitats and bird species that are unique to each of the respective Units.

Constant Effort Mist Netting: Oregon Caves National Monument

By monitoring birds using mist-nets we can gather demographic data on productivity and survivorship that are not provided from census monitoring. It is important however, to conduct censuses while operating the more labor-intensive netting station, as indicated by the increase of species documented through the use of multiple monitoring methods simultaneously.

Most songbird monitoring in North America, and the majority of bird conservation plans that have been developed for North America, focus on the breeding season. During migration and non-breeding season resources used by landbirds become more limited. Such limitations may have important demographic consequences. For this reason, a better understanding of habitat relationships outside of the breeding season is critical for developing conservation strategies for migrant and resident landbirds. Additionally, a complete avian inventory for the Klamath Network Parks should include efforts during the migration season, as indicated by the increased number of species encountered by the addition of migration season monitoring at Oregon Caves National Monument.

Fall Migration Census Effort: Lava Beds National Monument

The importance of including fall migration inventory efforts, as part of the Klamath Network's program, was further demonstrated by our work at Lava Beds National Monument. The high percentage of the species encountered that were not included on the Monument's hypothetical species list is likely a result of a tradition in wildlife management, which is focused on the breeding season. Two of the species added to the Monument's inventory list (Golden-crowned Sparrow and Northern Shrike) do not breed in the continental United States, and will only be encountered in northern California during the fall migration and winter (National Geographic 1999).

Klamath Demographic Monitoring Network

The National Park Service Klamath Network has a unique opportunity to augment its inventory efforts with data from the Klamath Demographic Monitoring Network. This is demonstrated by the use of archived data to confirm the occurrences of species in Lassen Volcanic, Crater Lake and Redwoods National Parks. By continuing efforts to archive all available bird monitoring data from within and around the Klamath's Recreation Area, Monuments and Parks, inventory efforts can focus on under sampled Units and/or during migration seasons.

Conclusion

An effective inventory and monitoring program is critical to understand the role protected lands of the National Park Service Klamath Network play in fulfilling bird conservation objectives. Through the inventory we will learn about the distribution of species across management Units, providing information about species that are protected by the Klamath Parks Network. With a monitoring program we can track the long-term population status, at both local and landscape scales, of species whose conservation depends on the protection of lands in and around the Klamath Parks Network.

When conducting inventories, it is important we look forward toward the monitoring phase of the Park Services Inventory and Monitoring Program. By carefully stratifying inventory efforts across units, habitats, and seasons, and by using standardized survey techniques, baseline inventory data from a network of monitoring stations will provide a foundation for an effective long-term vital signs monitoring program.

The use of multiple standardized monitoring methods for inventorying and monitoring birds in the Klamath Parks Network is critical for the effectiveness of the program. By conducting standard censuses relative abundance data adds needed complexity to an inventory, providing information such as the relative importance of habitats and/or Parks for providing breeding grounds for sensitive species such as neotropical migrant birds. Though point count censuses are efficient for inventorying and monitoring many species during the breeding season, the use of mist nets can greatly augment such methods by sampling species that are inadequately detected using point counts, while providing demographic data that provide insight into factors that drive population trends.

Additionally, it is critical that we devote resources towards inventorying and monitoring birds during migration seasons, as well as the breeding season. Units within the Klamath Parks Network provide critical habitat during the migration and wintering seasons for migrant and resident species of conservation concern. Here again it is important to consider multiple monitoring methods, such as areas search census and mist-netting, in that point count surveys are less effective outside of the breeding season, when birds are less vocal.

Finally, incorporating existing datasets into our inventory efforts will increase the effectiveness of our methods. It is important to focus some resources towards archiving data from previous efforts, that otherwise may go unused or even be lost. The data that have been archived thus far provide information that contributes to our knowledge of species occurrence, allowing us to spend the limited resources available for inventorying the Klamath Parks Network, on under sampled Units and/or during the migration season.

ACKNOWLEDGEMENTS

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Figure 1. Crater Lake National Park bird monitoring stations.

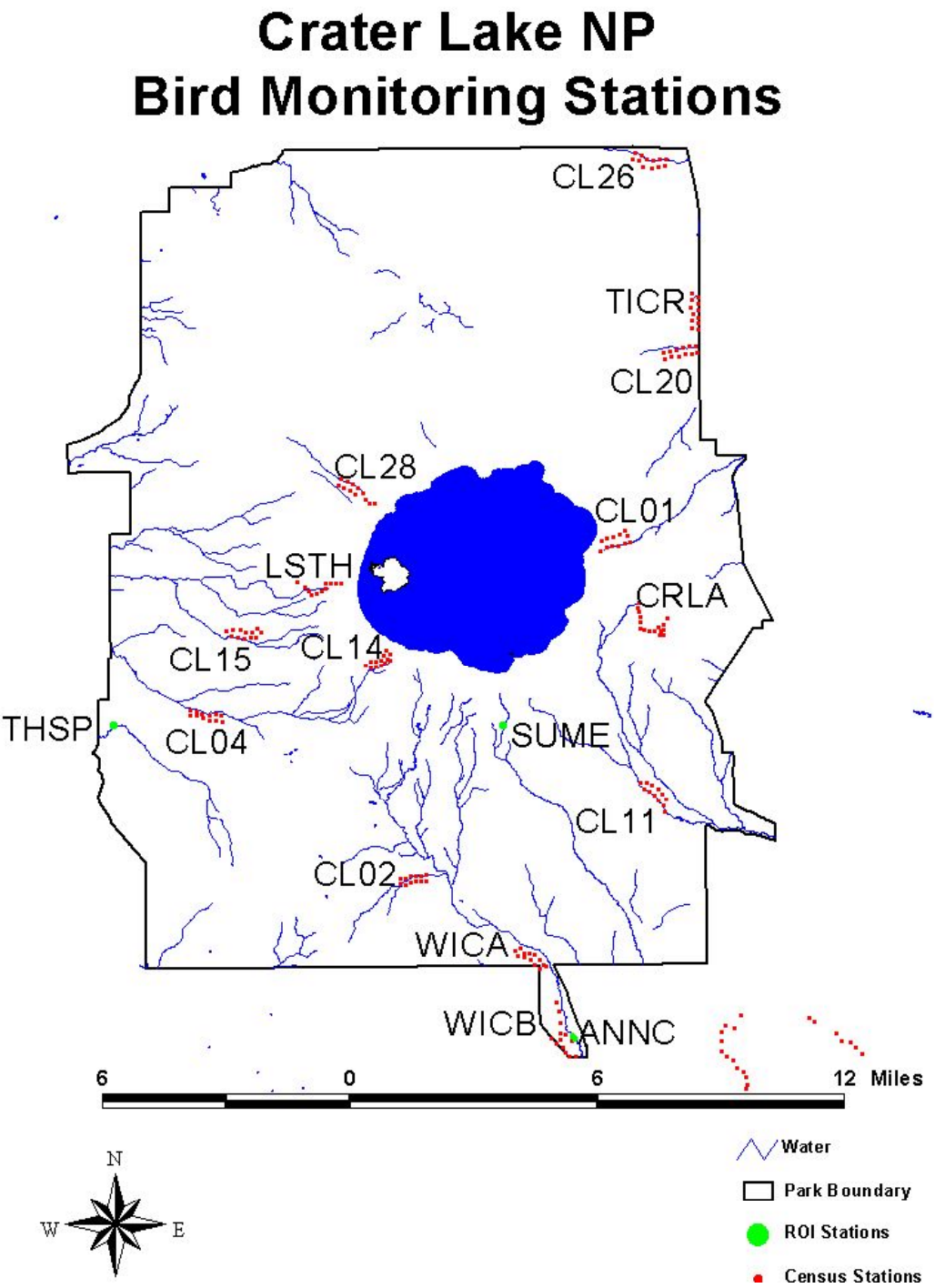

Figure 2. Whiskeytown National Recreation Area bird monitoring stations.

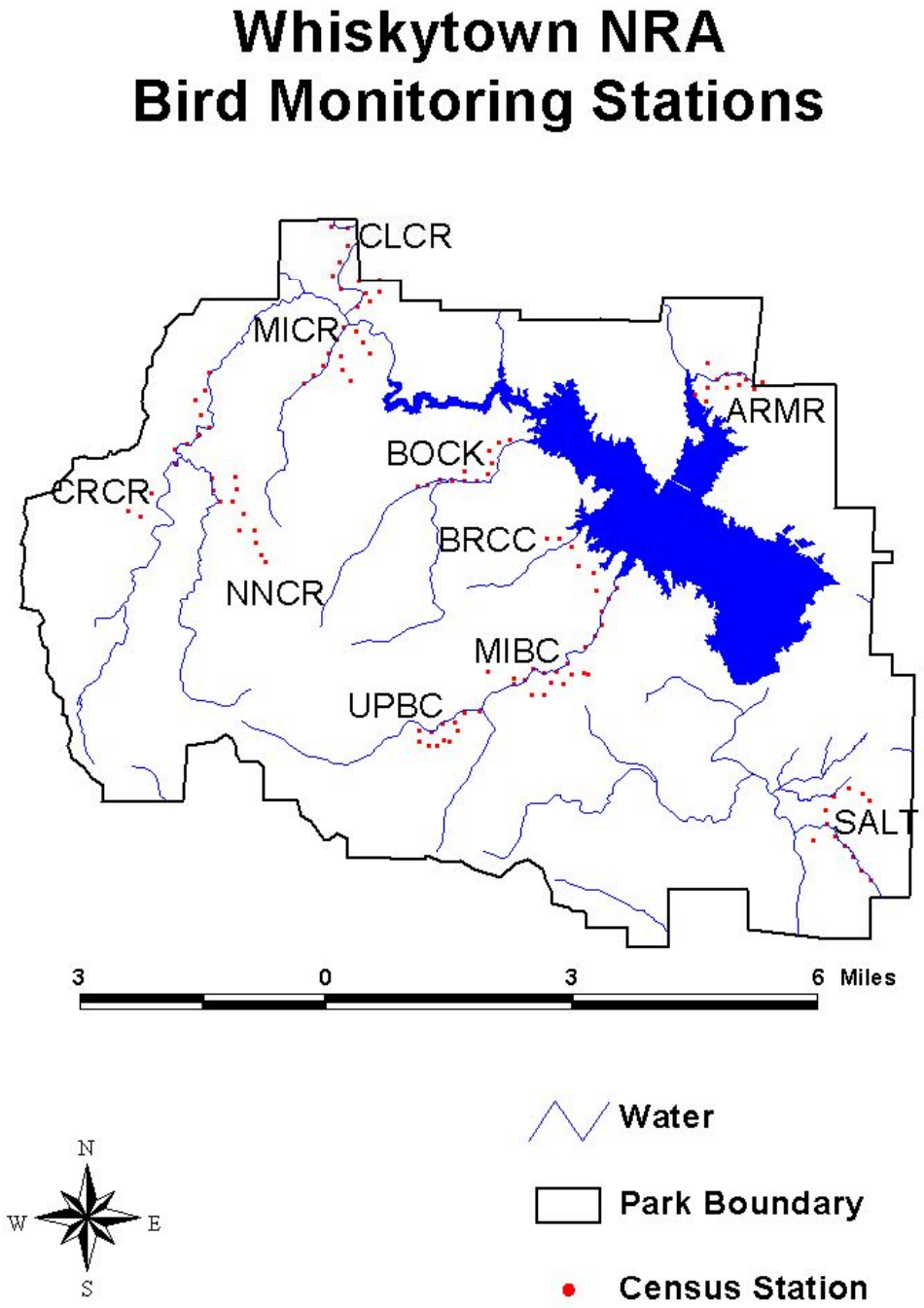

Figure 3. Incremental increase in number of species detected (Species Richness) with increasing inventory effort (No. Of Routes = number of census routes surveyed) at Crater Lake National Park.

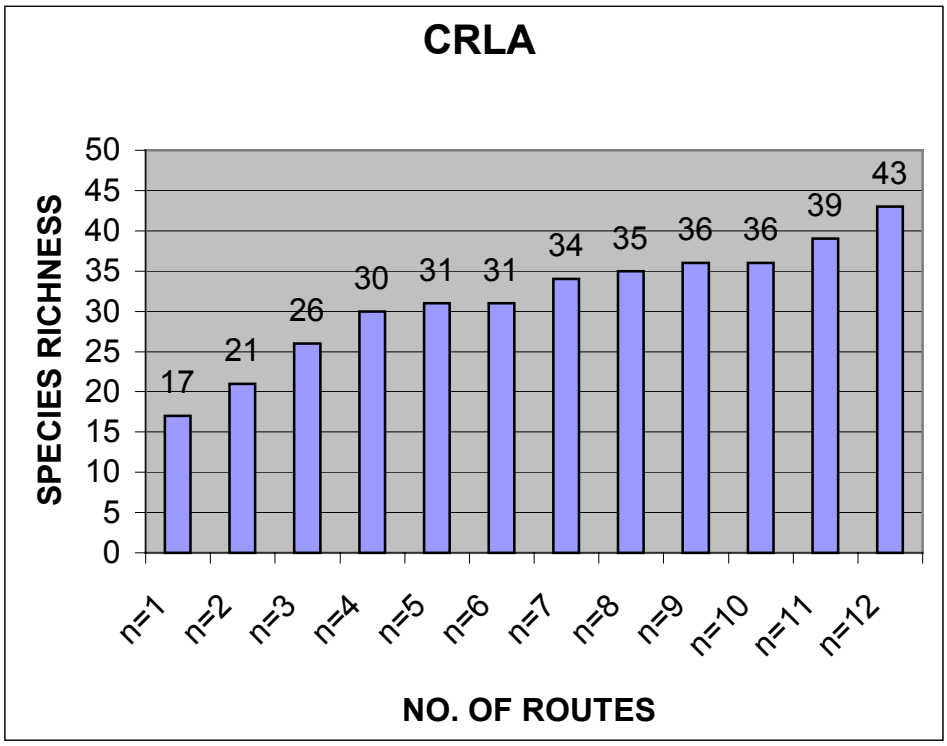

Figure 4. Incremental increase in number of species detected (Species Richness) with increasing inventory effort (No. Of Routes = number of census routes surveyed) at Whickeytown National Recreation Area.

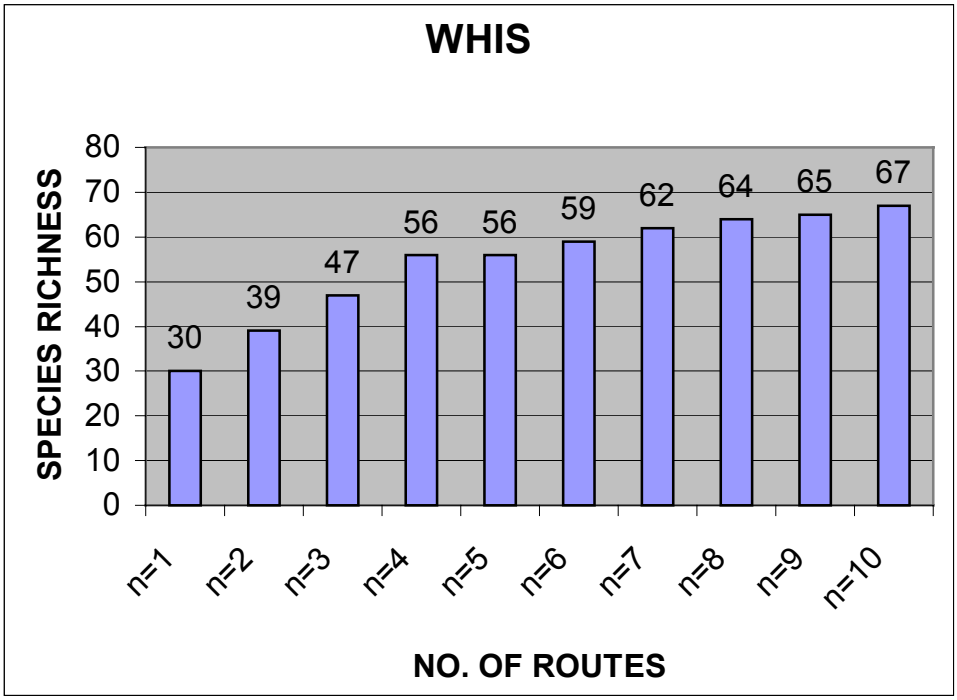

Figure 5. Number of additional bird species detected on incremental percentages of point count census stations within Crater Lake National Park (CRLA) and Whiskeytown National Recreation Area (WHIS).

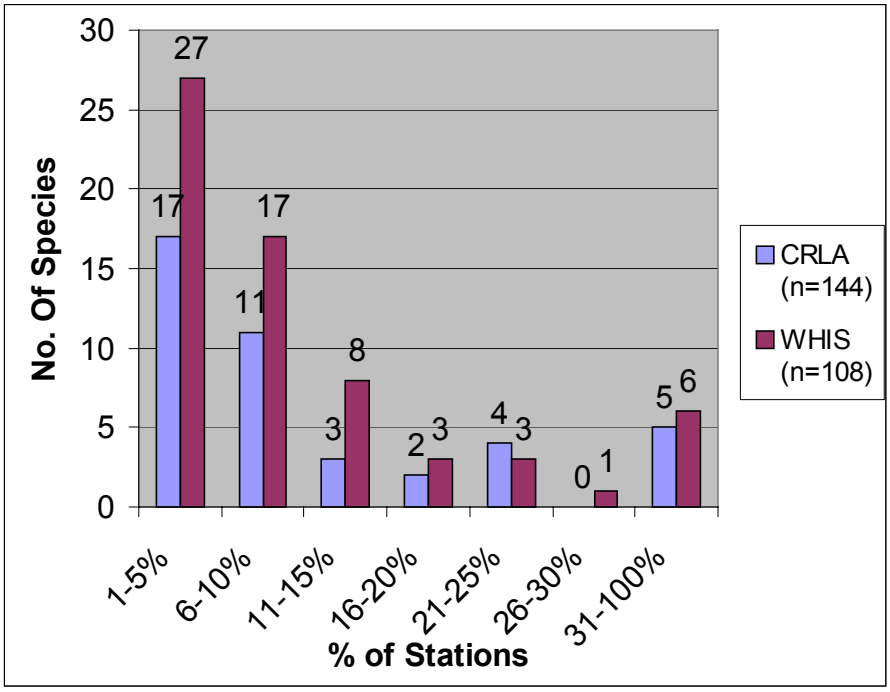

Figure 6. Comparison of the number species captured or encountered at the Oregon Caves National Monument constant-effort mist-netting station during the breeding season (June-August) with the number of species captured during the breeding and migration seasons (June-October).

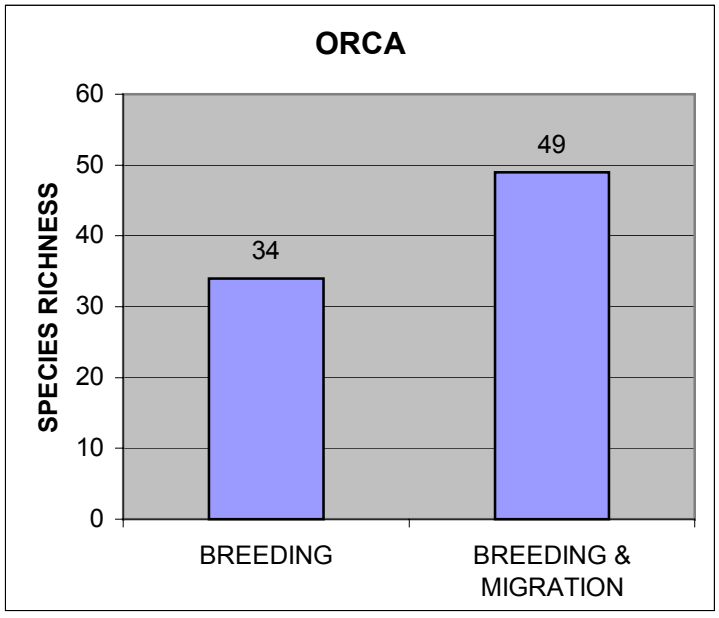

Figure 7. Klamath Demographic Monitoring Network bird monitoring stations in and around Redwood National Park.

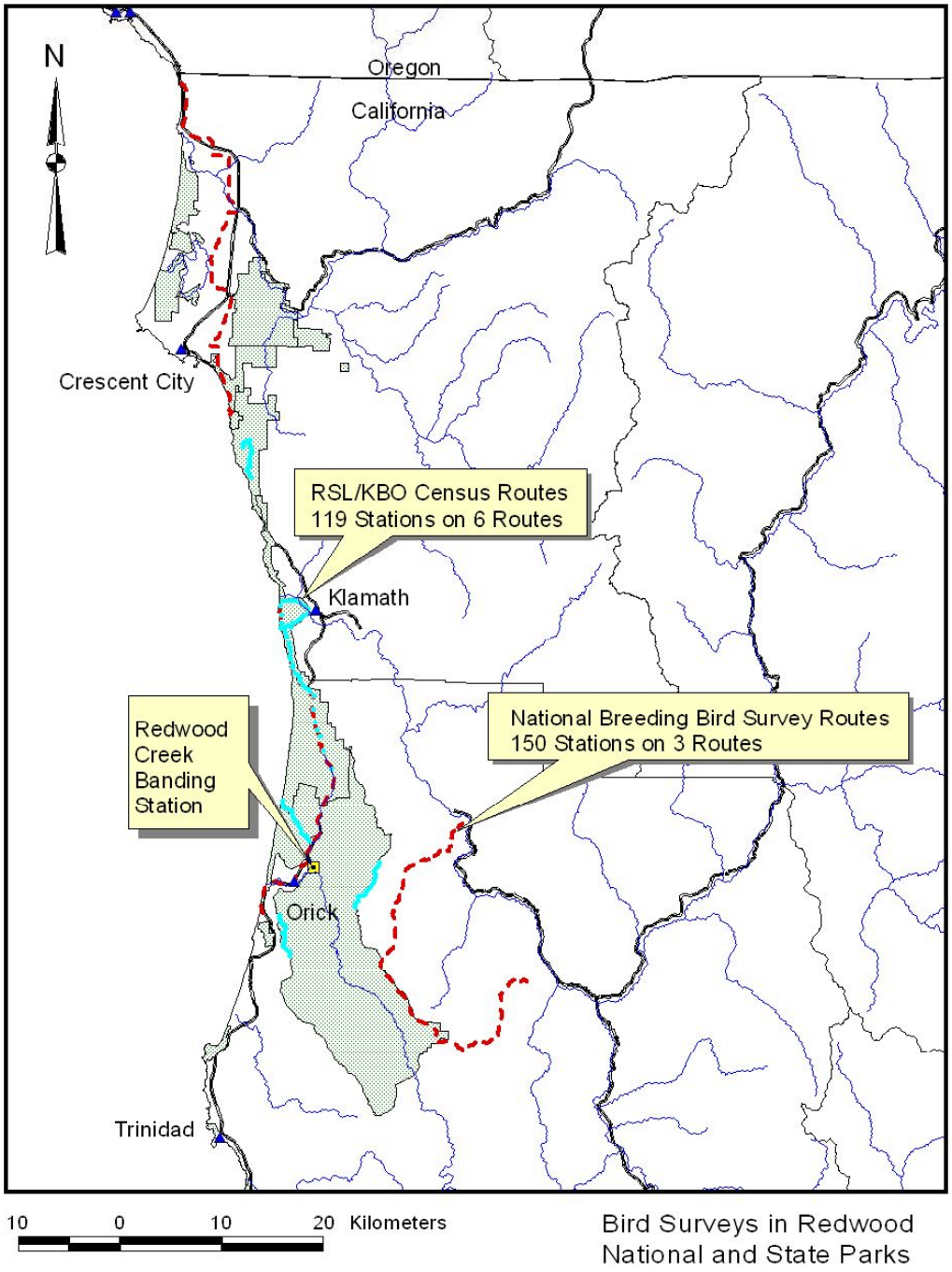

Table 1. Number of point count census stations along 12 routes in Crater Lake National Park, and route type ("Inv"=Routes associated Network Inventory Program; "Fire"= Routes associated with Joint Fire Sciences Program).

ROUTE	STATIONS	TYPE
CL01	12	Inv
CL02	12	Inv
CL04	12	Inv
CL11	12	Inv
CL14	12	Inv
CL15	12	Inv
CL20	12	Inv
CL26	12	Inv
CL28	12	Inv
LSTH	11	Fire
TICR	12	Fire
WICA	13	Fire
TOTAL	144	

Table 2. Number of point count census stations along 10 Network Inventory Program routes in Whiskeytown National Recreation Area.

ROUTE	STATIONS
ARMR	12
BOCK	12
BRCC	12
CLCR	12
CRCR	12
MIBC	12
MICR	12
NNCR	12
SALT	12
UPBC	12
TOTAL	120

Table 3. Number of detections, relative abundance and previous inventory status of birds detected during the 2002 breeding season along on 144 Crater Lake National Park point count census stations.

SCIENTIFIC NAME	COMMON NAME	DETECTIONS	ABUNDANCE	HYPOTHETICAL LIST	VOUCHER LIST
Dendroica coronata	Audubon's Warbler	118	1.32	yes	
Sitta canadensis	Red-breasted Nuthatch	78	0.66		yes
Turdus migratorius	American Robin	64	0.74		yes
Junco hyemalis	Oregon Junco	59	0.57	yes	
Parus gambeli	Mountain Chickadee	54	0.58	yes	
Piranga ludoviciana	Western Tanager	35	0.36		yes
Spizella passerina	Chipping Sparrow	32	0.28	yes	
Regulus satrapa	Golden-crowned Kinglet	32	0.26		yes
Empidonax hammondii	Hammond's Flycatcher	30	0.28		yes
Catharus guttatus	Hermit Thrush	29	0.29	yes	
Myadestes townsendi	Townsend's Solitaire	26	0.21		yes
Picoides villosus	Hairy Woodpecker	22	0.18	yes	
Cyanocitta stelleri	Steller's Jay	17	0.14		yes
Certhia americana	Brown Creeper	17	0.13	yes	
Contopus borealis	Olive-sided Flycatcher	15	0.13	xxx	xxx
Nucifraga columbiana	Clark's Nutcracker	15	0.19		yes
Loxia curvirostra	Red Crossbill	13	0.11		yes
Ixoreus naevius	Varied Thrush	13	0.10		yes
Colaptes auratus	Northern Flicker	11	0.10	yes	
Coccothraustes vespertinus	Evening Grosbeak	10	0.10	yes	
Carduelis pinus	Pine Siskin	10	0.07	yes	
Contopus sordidulus	Western Wood-Pewee	9	0.08	yes	
Carpodacus cassinii	Cassin's Finch	9	0.06		yes
Dendroica occidentalis	Hermit Warbler	9	0.08		yes
Vermivora ruficapilla	Nashville Warbler	8	0.06	yes	
Corvus corax	Common Raven	6	0.05	yes	
Perisoreus canadensis	Gray Jay	6	0.08		yes
Pipilo chlorurus	Green-tailed Towhee	6	0.06	yes	
Troglodytes troglodytes	Winter Wren	4	0.03	yes	
Vireo solitarius	Solitary Vireo	3	0.02		yes
Molothrus ater	Brown-headed Cowbird	3	0.02	yes	
Picoides arcticus	Black-backed Woodpecker	3	0.02	xxx	xxx
Regulus calendula	Ruby-crowned Kinglet	3	0.02	yes	
Buteo jamaicensis	Red-tailed Hawk	3	0.02	yes	
Empidonax difficilis	Pacific-slope Flycatcher	2	0.01		yes
Parus rufescens	Chestnut-backed Chickadee	2	0.01	yes	
Sialia currucoides	Mountain Bluebird	2	0.01		yes
Dryocopus pileatus	Pileated Woodpecker	2	0.01	yes	
Sphyrapicus ruber	Red-breasted Sapsucker	2	0.01	yes	
Carpodacus purpureus	Purple Finch	1	0.01	yes	
Empidonax oberholseri	Dusky Flycatcher	1	0.01		yes
Passerella iliaca	Fox Sparrow	1	0.01		yes

DETECTIONS = Number of individuals detected.
ABUNDANCE = Relative abundance; Number of individuals detected per point.
HYPOTHETICAL LIST = “yes” indicates species hypothetically considered to occur in Crater Lake National Park. “xxx” indicates species not included on Park’s hypothetical or voucher list.
VOUCHER LIST = “yes” indicates confirmed occurrence of species in Crater Lake National Park. “xxx” indicates species not included on Park’s hypothetical or voucher list.

Table 4. Number of detections, relative abundance and previous inventory status of birds detected during the 2002 breeding season along on 120 Whiskey Town National Recreation Area point count census stations.

SCIENTIFIC NAME	COMMON NAME	DETECTIONS	ABUNDANCE	HYPOTHETICAL LIST	VOUCHER LIST
Dendroica nigrescens	Black-throated Gray Warbler	71	1.03	yes	
Pipilo erythrophthalmus	Eastern Towhee	55	0.75	yes	
Vermivora celata	Orange-crowned Warbler	51	0.65	yes	
Piranga ludoviciana	Western Tanager	38	0.46	yes	
Vireo solitarius	Solitary Vireo	37	0.45	yes	
Pheucticus melanocephalus	Black-headed Grosbeak	36	0.48	yes	
Cyanocitta stelleri	Steller's Jay	32	0.29	yes	
Hirundo pyrrhonota	Cliff Swallow	31	0.26	yes	
Vireo huttoni	Hutton's Vireo	27	0.23	yes	
Vermivora ruficapilla	Nashville Warbler	25	0.33	yes	
Carduelis psaltria	Lesser Goldfinch	23	0.32	yes	
Chamaea fasciata	Wrentit	22	0.23	yes	
Oreortyx pictus	Mountain Quail	21	0.23	yes	
Junco hyemalis	Oregon Junco	19	0.25	yes	
Zenaida macroura	Mourning Dove	16	0.18	yes	
Contopus sordidulus	Western Wood-Pewee	15	0.15	yes	
Molothrus ater	Brown-headed Cowbird	15	0.15	yes	
Sitta canadensis	Red-breasted Nuthatch	14	0.16	yes	
Melanerpes formicivorus	Acorn Woodpecker	13	0.15	yes	
Turdus migratorius	American Robin	12	0.14	yes	
Colaptes auratus	Northern Flicker	12	0.13	yes	
Vireo gilvus	Warbling Vireo	12	0.17	yes	
Myiarchus cinerascens	Ash-throated Flycatcher	11	0.13	yes	
Carpodacus purpureus	Purple Finch	10	0.13	yes	
Parus inornatus	Plain Titmouse	10	0.10	yes	
Empidonax difficilis	Pacific-slope Flycatcher	9	0.08	yes	
Polioptila caerulea	Blue-gray Gnatcatcher	9	0.10	yes	
Callipepla californica	California Quail	9	0.12	yes	
Passerina amoena	Lazuli Bunting	9	0.09	yes	
Picoides pubescens	Downy Woodpecker	8	0.09	yes	
Icteria virens	Yellow-breasted Chat	8	0.08	yes	
Dendroica petechia	Yellow Warbler	8	0.10	yes	
Dendroica coronata	Audubon's Warbler	7	0.08	yes	
Picoides villosus	Hairy Woodpecker	7	0.06	yes	
Thryomanes bewickii	Bewick's Wren	7	0.06	yes	
Corvus corax	Common Raven	6	0.06	yes	
Calypte anna	Anna's Hummingbird	6	0.06	yes	
Troglodytes aedon	House Wren	6	0.07	yes	
Aphelocoma coerulescens	Florida Scrub-Jay	6	0.05	yes	
Icterus galbula	Baltimore Oriole	5	0.04	yes	
Psaltriparus minimus	Bushtit	4	0.09	yes	
Branta canadensis	Canada Goose	4	0.06	yes	
Melospiza melodia	Song Sparrow	4	0.03	yes	
Wilsonia pusilla	Wilson's Warbler	4	0.03	yes	
Troglodytes troglodytes	Winter Wren	3	0.03	yes	

Table 4. (Continued)

SCIENTIFIC NAME	COMMON NAME	DETECTIONS	ABUNDANCE	HYPOTHETICAL LIST	VOUCHER LIST
Parus rufescens	Chestnut-backed Chickadee	3	0.03	yes	
Sayornis nigricans	Black Phoebe	3	0.03	yes	
Colaptes auratus	Northern Flicker	3	0.03	yes	
Tachycineta bicolor	Tree Swallow	3	0.03	yes	
Spizella passerina	Chipping Sparrow	2	0.02	yes	
Myadestes townsendi	Townsend's Solitaire	2	0.03	yes	
Contopus borealis	Olive-sided Flycatcher	2	0.02	yes	
Corvus brachyrhynchos	American Crow	2	0.02	yes	
Cinclus mexicanus	American Dipper	2	0.03	yes	
Ceryle alcyon	Belted Kingfisher	2	0.02	yes	
Actitis macularia	Spotted Sandpiper	2	0.02	yes	
Cathartes aura	Turkey Vulture	2	0.03	yes	
Regulus satrapa	Golden-crowned Kinglet	1	0.01	yes	
Empidonax oberholseri	Dusky Flycatcher	1	0.01	yes	
Columba fasciata	Band-tailed Pigeon	1	0.01	yes	
Bombycilla cedrorum	Cedar Waxwing	1	0.03	yes	
Mergus merganser	Common Merganser	1	0.01	yes	
Ardea herodias	Great Blue Heron	1	0.01	yes	
Butorides virescens	Green Heron	1	0.01	xxx	xxx
Oporornis tolmiei	MacGillivray's Warbler	1	0.01	yes	
Glaucidium gnoma	Northern Pygmy-Owl	1	0.01	yes	
Stelgidopteryx serripennis	Northern Rough-winged Swallow	1	0.02	yes	

DETECTIONS = Number of individuals detected.
ABUNDANCE = Relative abundance; Number of individuals detected per point.
HYPOTHETICAL LIST = “yes” indicates species hypothetically considered to occur in Whiskeytown National Recreation Area. “xxx” indicates species not included on Recreation Area’s hypothetical or voucher list.
VOUCHER LIST = “yes” indicates confirmed occurrence of species in Whiskeytown National Recreation Area. “xxx” indicates species not included on Recreation Area’s hypothetical or voucher list.

Table 5. Comparison of the relative detection frequency (percent of stations on which species were detected) of the most regularly occurring bird species at point count census stations (species detected at > 19% of stations) in Crater Lake National Park (CRLA) and Whiskeytown National Recreation Area (WHIS).

Most Abundant Crater Lake Birds	CRLA (n=140)	WHIS (n=120)
Audubon's Warbler	82%	6%
Red-breasted Nuthatch	54%	13%
American Robin	44%	11%
Oregon Junco	41%	18%
Mountain Chickadee	38%	0%
Western Tanaget	24%	35%
Chipping Sparrow	22%	2%
Golden-crowned Kinglet	22%	1%
Hammonds Flycatcher	21%	0%
Hermit Thrush	20%	0%

Most Abundant Whiskeytown Birds	WHIS (n=120)	CRLA (n=140)
Black-throated Gray Warbler	66%	0%
Spotted Towhee	51%	0%
Orange-crowned Warbler	47%	0%
Western Tanager	35%	24%
Cassin's Vireo	34%	2%
Black-headed Grosbeak	33%	0%
Steller's Jay	30%	12%
Hutton's Vireo	25%	0%
Nashville Warbler	23%	6%
Lesser Goldfinch	21%	0%
Wrentit	20%	0%

Table 6. Species detected (C=captured, E=Encountered) during the breeding (June-August) and migration (Aseptember-October) season at the Oregon Caves National Monument constant-effort mist-netting stations, and previous inventory status of birds detected.

SCIENTIFIC NAME	COMMON NAME	BREEDING	MIGRATION	HYPOTHETICAL LIST	VOUCHER LIST
Branta canadensis	Canada Goose		E	xxx	xxx
Bonasa umbellus	Ruffed Grouse		E	yes	
Columba fasciata	Band-tailed Pigeon		E	yes	
Cathartes aura	Turkey Vulture		E	yes	
Accipiter striatus	Sharp-shinned Hawk		E	yes	
Bubo virginianus	Great Horned Owl	E	E	yes	
Glaucidium gnoma	Northern Pygmy-Owl	E	E	yes	
Picoides pubescens	Downy Woodpecker	E	E	yes	
Sphyrapicus ruber	Red-breasted Sapsucker	C	C	yes	
Dryocopus pileatus	Pileated Woodpecker	E	E	yes	
Colaptes auratus	Northern Flicker	E	E	yes	
Selasphorus rufus	Rufous Hummingbird	C		yes	
Selasphorus sasin	Allen's Hummingbird	C		xxx	xxx
Contopus borealis	Olive-sided Flycatcher	E		yes	
Empidonax difficilis	Pacific-slope Flycatcher	C	C	yes	
Empidonax oberholseri	Dusky Flycatcher		C	yes	
Cyanocitta stelleri	Steller's Jay	C	C	yes	
Perisoreus canadensis	Gray Jay	C	C	yes	
Corvus corax	Common Raven	E	E	yes	
Corvus brachyrhynchos	American Crow		E	yes	
Turdus migratorius	American Robin		E	yes	
Carpodacus purpureus	Purple Finch	C		yes	
Zonotrichia atricapilla	Golden-crowned Sparrow		C	yes	
Junco hyemalis	Oregon Junco	C	C	yes	
Passerella iliaca	Fox Sparrow		C	yes	
Pheucticus melanocephalus	Black-headed Grosbeak	C		yes	
Dendragapus obscurus	Blue Grouse		E	yes	
Vireo gilvus	Warbling Vireo	E	E	yes	
Vireo solitarius	Cassin's Vireo	E		yes	
Vermivora ruficapilla	Nashville Warbler	C		yes	
Vermivora celata	Orange-crowned Warbler	C	C	yes	
Dendroica coronata	Yellow-rumped Warbler	C		yes	
Dendroica townsendi	Townsend's Warbler		C	xxx	xxx
Dendroica occidentalis	Hermit Warbler	C		yes	
Oporornis tolmiei	MacGillivray's Warbler	C	C	yes	
Wilsonia pusilla	Wilson's Warbler	C	C	yes	
Troglodytes troglodytes	Winter Wren	C	C	yes	
Certhia americana	Brown Creeper	C	E	yes	
Sitta canadensis	Red-breasted Nuthatch	C	E	yes	
Parus atricapillus	Black-capped Chickadee		E	yes	
Parus gambeli	Mountain Chickadee	E	E	yes	
Parus rufescens	Chestnut-backed Chickadee	C	C	yes	

Table 6. (Continued)

SCIENTIFIC NAME	COMMON NAME	BREEDING	MIGRATION	HYPOTHETICAL LIST	VOUCHER LIST
Psaltriparus minimus	Bushtit	E		yes	
Regulus satrapa	Golden-crowned Kinglet	C	C	yes	
Regulus calendula	Ruby-crowned Kinglet		C	yes	
Myadestes townsendi	Townsend's Solitaire	C	E	yes	
Catharus ustulatus	Swainson's Thrush	C	C	yes	
Catharus guttatus	Hermit Thrush	E	C	yes	
Ixoreus naevius	Varied Thrush	E	E	yes	

HYPOTHETICAL LIST = "yes" indicates species hypothetically considered to occur in Oregon Caves National Monument. "xxx" indicates species not included on Monument's hypothetical or voucher list.
VOUCHER LIST = "yes" indicates confirmed occurrence of species in Oregon Caves National Monument. "xxx" indicates species not included on Monument's hypothetical or voucher list.

Table 7. Species detected during 2002 fall mirgration season area search censuses at Lava Beds National Monument and previous inventory status of birds detected.

SCIENTIFIC NAME	COMMON NAME	HYPOTHETICAL LIST	VOUCHER LIST
Accipiter cooperii	Cooper's Hawk	yes	
Eremophila alpestris	Horned Lark	xxx	xxx
Colaptes auratus	Northern Flicker		yes
Pica pica	Black-billed Magpie	xxx	xxx
Corvus corax	Common Raven	yes	
Nucifraga columbiana	Clark's Nutcracker		yes
Gymnorhinus cyanocephalus	Pinyon Jay	xxx	xxx
Sturnella neglecta	Western Meadowlark		yes
Carpodacus cassinii	Cassin's Finch	yes	
Carduelis tristis	American Goldfinch	yes	
Carduelis pinus	Pine Siskin	yes	
Pooecetes gramineus	Vesper Sparrow	xxx	xxx
Zonotrichia leucophrys	White-crowned Sparrow	yes	
Zonotrichia atricapilla	Golden-crowned Sparrow	xxx	xxx
Junco hyemalis	Oregon Junco	yes	
Bombycilla cedrorum	Cedar Waxwing	yes	
Lanius excubitor	Northern Shrike	xxx	xxx
Catherpes mexicanus	Canyon Wren	xxx	xxx
Thryomanes bewickii	Bewick's Wren	yes	
Baeolophus ridgwayi	Juniper Titmouse	xxx	xxx
Chamaea fasciata	Wrentit		
Psaltriparus minimus	Bushtit	yes	
Regulus calendula	Ruby-crowned Kinglet	yes	
Myadestes townsendi	Townsend's Solitaire	yes	
Turdus migratorius	American Robin		yes
Sialia currucoides	Mountain Bluebird	yes	

HYPOTHETICAL LIST = "yes" indicates species hypothetically considered to occur in Lava Beds National Monument. "xxx" indicates species not included on Monument's hypothetical or voucher list.
VOUCHER LIST = "yes" indicates confirmed occurrence of species in Lava Beds National Monument. "xxx" indicates species not included on Monument's hypothetical or voucher list.

APPENDIX A.

Table structure and field descriptions for Klamath Parks Network 2002 variable circular plot point count census dataset.

Field	Field Name	Type	Length	Dec	Description
1	SOURCE	CHARACTER	10		Original data entry file
2	STATE	CHARACTER	2		
3	PROJECT	CHARACTER	10		
4	ROUTE	CHARACTER	4		
5	STATION	CHARACTER	2		
6	RTSTA	CHARACTER	10		
7	EASTING	NUMERIC	12		NAD27 UTM Zone 10
8	NORTHING	NUMERIC	12		NAD27 UTM Zone 10
9	MONTH	CHARACTER	2		
10	DAY	CHARACTER	2		
11	YEAR	CHARACTER	4		
12	OBSERVER	CHARACTER	3		
13	TIME	CHARACTER	4		
14	TEMPC	NUMERIC	20	5	
15	CLOUD	NUMERIC	20	5	
16	WIND	CHARACTER	1		
17	PRECIP	CHARACTER	1		
18	NOISE	CHARACTER	1		Noise level during census
19	NUMBER	CHARACTER	9		AOU species number
20	SPECIES	CHARACTER	4		AOU species code
21	COM_NAM	CHARACTER	34		AOU common name
22	SCIENTIFIC	CHARACTER	50		Genus and species name
23	DETECTTYPE	CHARACTER	1		Detection type
24	DETECTLOC	CHARACTER	2		Location of detected individual(s)
25	DIST2	NUMERIC	4		Distance of detected individual(s)
26	TOTAL	NUMERIC	4		# of individuals detected
27	LT50	NUMERIC	4		# of individuals detected within 50m
28	GT50	NUMERIC	4		# of individuals detected outside 50m
29	FLY	NUMERIC	4		# of individuals detected flying over
30	BREEDING	CHARACTER	1		Evidence of breeding status